PATENT SPECIFICATION

584,841

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PROVISIONAL SPECIFICATION

Improvements in or relating to Apparatus for the Delivery of Liquids in Measured Quantities

We, VERNEY STOTT and ISABEL HODGSON HADFIELD, both of the National Physical Laboratory, Teddington, Middlesex, and both British Subjects, do hereby declare the nature of this invention to be as follows:—

This invention relates to devices for the delivery of liquids in measured quantities. Its object is to provide a device of very simple construction to deliver a measured quantity of liquid to a high degree of accuracy.

The device is of the syringe type and may conveniently be called a syringe-pipette. It is characterised by the provision of stops integral with the barrel adapted to check the forward movement of the piston in two or more positions. By these means the length of stroke of the piston may be controlled. Both barrel and piston may advantageously be made of glass and the device then consists simply of two glass portions which may easily be taken apart and cleaned, or, if necessary sterilised.

When it is desired to deliver measured quantities, all equal in volume, only two stops are necessary. A convenient construction, if the whole is of glass, is to form a right angle bend at the top of the piston rod and to cut a step in the barrel, the end of the barrel and the step being ground square to the axis of the barrel. It is also an advantage to grind a flat surface on the underside of the right angle bend at right angles to the axis of the piston. One stop position is then provided when the underside of the right angle bend on the piston rod makes contact with the flat surface at the end of the barrel and the other when it comes into contact with the flat surface of the step cut in the barrel.

The device may also be used for the delivery of more than one measured volume by providing additional steps on the barrel or by cutting slots of varying length in the barrel.

The end of the barrel itself may be drawn out into a suitable delivery jet. The invention is equally applicable, however, to any convenient means of delivery, for example, the lower end of the barrel may be furnished with a conical tip to which hypodermic needles can be attached, as customary on hypodermic syringes. Preliminary tests with 0.5 ml and with 0.1 ml syringe pipettes of the all-glass type described have shown that the successive deliveries are within 0.001 ml of their mean.

The device is not limited to small capacities as 0.5 ml and 1.0 ml, but is equally applicable to all capacities normally covered by syringes and pipettes.

Dated the 29th day of January, 1945.

H. K. WARR-LANGTON,
Agent for the Applicants.

COMPLETE SPECIFICATION

Improvements in or relating to Apparatus for the Delivery of Liquids in Measured Quantities

We, VERNEY STOTT and ISABEL HODGSON HADFIELD, both of the National Physical Laboratory, Teddington, Middlesex, and both British Subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to devices for the delivery of liquids in measured volumes. Its object is to provide a device of very simple construction to deliver a measured volume of liquid to a high degree of accuracy.

It is already known to construct syringe devices so that they may deliver predetermined measured volumes of liquid. In some of them the piston stroke is limited by the action of two stops, one of which checks the withdrawal or charging stroke and the other the forward or discharging stroke, i.e. the stops work in opposite directions. Such stops have been

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adjustable in position and have been used in conjunction with a graduated barrel or piston rod. Such arrangements are not adapted to work with the accuracy here aimed at, because they are not adapted to stop the movements of the piston with sufficient precision. Another syringe construction has been proposed for discharging a succession of measured volumes, in which the piston rod is furnished with a groove comprising disaligned longitudinal sections of determined length, joined by circumferential sections to form a continuous groove, the groove cooperating with a loose stop adapted to abut against the barrel cover. Thus during charging by withdrawing the piston, the stop is carried back with the piston rod but can then be manipulated into the position in which it abuts the cylinder cover. Thereafter by rotating the stop in relation to the rod to bring it into line with the corresponding longitudinal section of the groove, the piston can be thrust forward by the length of this section of the groove so discharging a measured volume. Then by rotating the stop until the next longitudinal section comes into line, the piston can again be thrust forward by the length of the section, and so on. The loose stop arrangement is not adapted to check the piston movement with sufficient precision to give an accuracy of the order here aimed at.

The subject of the present invention is also a device of the syringe type and may conveniently be termed a syringe-pipette. It is characterised by the provision of coacting stops integral with the barrel and with the piston rod, whereby the forward or discharge movement of the piston can be checked in two or more determined positions, one of which is a starting or zero position (to which the over-charged syringe is discharged before delivery of the measured volume) and the other or each of the others of which corresponds to the discharge of a, or a respective, measured volume when the piston is moved from the starting position thereto.

When it is desired to deliver measured volumes of only one value, only two determined positions are necessary, and there may be two stops on the piston rod and one on the barrel, or one on the rod and two on the barrel.

When volumes of several different values may be required, additional positions are provided. One stop will be used to give the starting position, and one of the other stops selected to check the piston in a second position according to the volume to be measured. There may be three or more stops on the piston rod and one on the barrel, or one on the rod and three or more on the barrel, or even a plurality on both rod and barrel. It would also be possible to use the multi-position arrangements to discharge a succession of measured volumes, working from stop to stop.

Both barrel and piston (with its rod) may advantageously be made of glass and the device then consists simply of two glass portions which may easily be taken apart and cleaned, or, if necessary sterilised.

A construction according to the invention is illustrated by way of example in the accompanying drawing, in which:—

Fig. 1 is an elevation showing the device in the starting position, and

Fig. 2 is an elevation showing the device in the discharged position.

The illustrated example is an all-glass construction, comprising a barrel 1, a piston 2 sliding therein, and a piston rod 3 integral with the piston. The barrel and piston must be circular and parallel within close enough limits to enable the piston to be rotated and reciprocated in fluid-tight fashion.

The illustrated example is designed for delivering one measured volume only. Accordingly only one stop on the piston rod and two on the barrel (or *vice versa*) are necessary. A convenient arrangement with an all glass construction is, as shown, to form a right angle bend 4, at the top of the piston rod 3 and to cut a step 5 in the barrel 1, the end 6 of the barrel and the step being ground square to the axis of the barrel. It is also an advantage to grind a flat surface on the underside of the right angle bend 4, at right angles to the axis of the piston. One stop position is then provided when the underside of the right angle bend 4 makes contact with the flat surface at the end 6 and the other when it comes into contact with the flat surface of the step 5. The end of the barrel itself may as shown be drawn out into a suitable delivery jet 7. The invention is equally applicable, however, to any convenient means of delivery, for example, the lower end of the barrel may be furnished with a conical tip to which hypodermic needles can be attached as customary on hypodermic syringes.

It will be understood that in use, starting with the piston in its innermost position, i.e. with the bend 4 against the step 5, or thereabouts, the device is charged in the usual way, care being taken to withdraw the piston to a position in which the bend 4 is well beyond the end 6 of the barrel, so that the syringe is over-charged. The syringe is then discharged until the bend 4 abuts the end 6 (position of Fig. 1) and it is now ready to deliver

the measured volume. To do this, the barrel is turned until the bend 4 is clear of the end 6 and the piston is then thrust forward until the bend 4 abuts the step 5 (position of Fig. 2).

As an example of the order of accuracy obtainable with the invention, tests with 0.5 ml and with 1.0 ml syringe pipettes of the all-glass type described have shown that the successive deliveries are within 0.001 ml of their mean.

The device is not limited to small capacities as 0.5 ml and 1.0 ml, but is equally applicable to all capacities normally covered by syringes and pipettes.

The device illustrated could readily be modified for the delivery of more than one measured volume by providing additional steps similar to 5 on the barrel at different longitudinal locations, or by cutting slots of varying lengths in the barrel and of sufficient width to admit the bend 4.

The device illustrated could also be modified by providing two (or more) projecting arms such as 4 on the piston rod 3, each adapted to coact with the end 6 of the barrel. The device will first be discharged until the first arm, i.e. the arm nearest the piston, reaches the end 6 of the barrel. To discharge the measured volume the rod is then turned and the discharge movement continued until the next arm reaches the end 6, and so on if there are more than two arms. It will be understood that the side of the barrel will be cut away over a sufficient angle and sufficient length, and the arms arranged at suitable angles to one another (i.e. seen in axial direction) to enable these manipulations to be carried out. The arms will preferably all be provided with a ground flat surface on the underside, at right angles to the axis of the piston, as described above with reference to the bend 4.

A still further modification would be to provide a plurality of arms on the piston rod and a plurality of steps on the barrel, though in general such complication is unnecessary as a device of the present character is usually only required for delivering a single volume or perhaps two. By way of example, however, by providing two arms and two steps, the spacing of the arms being different from that of the steps, four volumes can be provided for. Assuming that the arms are more closely spaced than the steps, but are not spaced less than half the spacing of the steps, the four volumes will be obtained in ascending order of magnitude as follows:—

1. Between the position of abutment of the second arm (i.e. the arm furthest from the piston) against the end of the barrel and the position of abutment of the first arm against the step.

2. Between the positions of abutment of the first arm and second arm respectively against the end of the barrel; or between the position of abutment of the first arm and second arm respectively against the step.

3. Between the position of abutment of the first arm against the end of the barrel and the position of abutment of the first arm against the step.

4. Between the position of abutment of the first arm against the end of the barrel and the position of abutment of the second arm against the step.

It will be understood that the barrel will also have to be cut away at the side beyond the step to provide for the greatest volume (and also the second way of delivering the second volume) and that the angle subtended by the barrel end, the step and the cut-away, and the angle between the arms must be arranged to permit the required manipulations. Also, as before, flats may be ground on the undersides of the arms.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A syringe device for the delivery of liquids in measured volumes characterised by the provision of coacting stops integral with the barrel and with the piston rod, whereby the discharge movement of the piston can be checked in two or more determined positions, one of which is the starting or zero position (to which the over-charged syringe is discharged before delivery of the measured volume) and the other or each of the others of which corresponds to the discharge of a, or a respective, measured volume.

2. A device according to claim 1 in which there is one stop on the piston rod and a plurality or stops on the barrel.

3. A device according to claim 1 or 2 having two determined positions only so that the device delivers one measured quantity only.

4. A device according to claims 1, 2 or 3 of all-glass construction.

5. A device according to claim 4 in which the piston rod stop is constituted by a right angle bend formed in it.

6. A device according to claim 5 in which a flat surface is ground on the underside of the right angle bend, at right angles to the axis of the piston.

7. A device according to claim 4, 5, or 6 in which the barrel stops are formed by the end of the barrel and a step or steps cut in the barrel, the stops being ground square to the axis of the barrel.

8. A device for the delivery of liquids in measured quantities substantially as described and as shown in the accompanying drawing.

Dated the 27th day of February, 1946.

H. K. WARR-LANGTON,
Agent for the Applicants.

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Fig. 1.

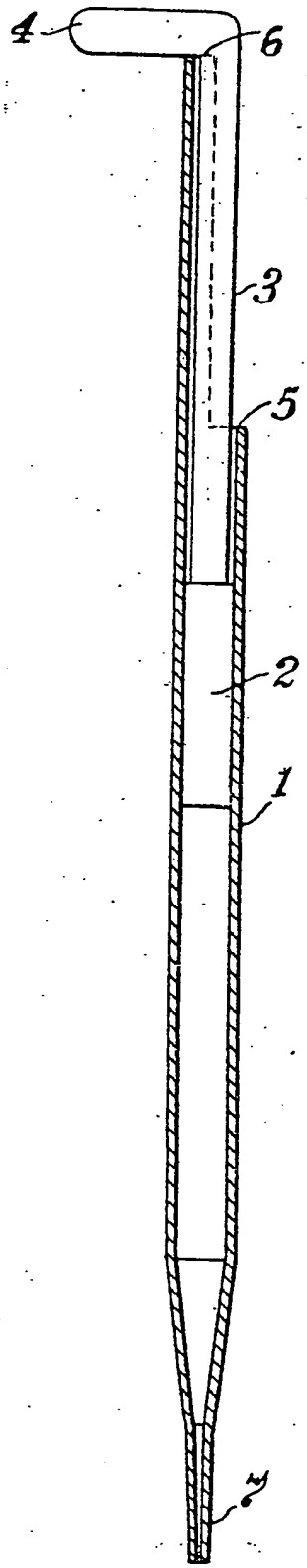
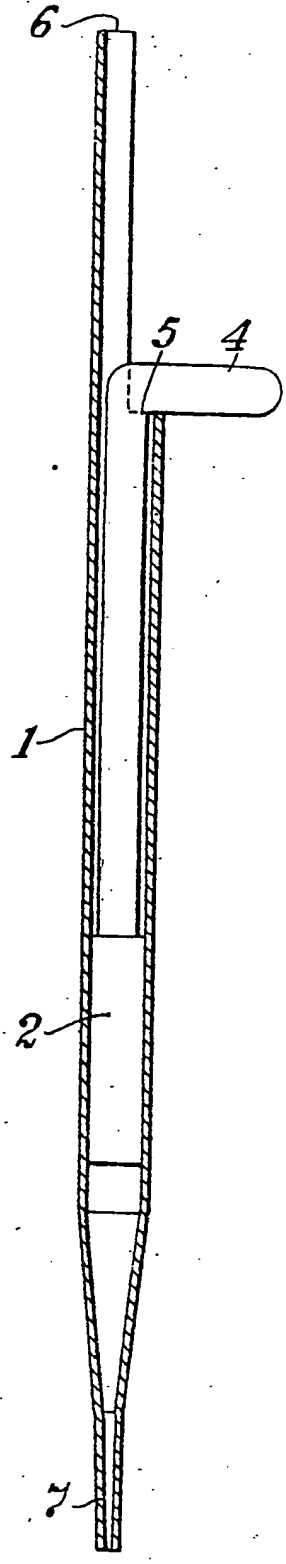


Fig. 2.



H.M.S.O. (Ty. P.)